NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

3. Summaries of all papers, as submitted by contributors, will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

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DEVELOPMENT OF THE MINERAL RESOURCES IN NEW STATES
ACCORDING TO ISRAELI EXPERIENCE

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The basic technological and economic principles characterizing and directing the planning and development activities connected with the exploitation of the mineral resources in Israel are as follows:

a) The economic and efficient exploitation of mineral resources play a decisive role in strengthening and stabilizing the Israel economy.

Although the economic value of the minerals' potential is today much higher than its actual value, the mineral industry is already one of the chief factors whose relative importance and vitality is continuously and constantly growing in widening the industrial production, increasing the exports and ensuring additional employment resources.

This basic principle may be demonstrated by the following figures:

	Today	1970
Annual Output	800,000 tons	2,000,000 tons
Annual Turnover	IL64,000,000	IL250,000,000
Export Value	$11,000,000	$75,000,000

The percentage of the mineral industry export in the national total export is constantly growing, is already over 20% of the total industrial export and it is planned and expected that in 1970 the minerals' export will reach and overpass the citrus branch export.

The exploitation of the mineral resources as the basis of chemical, mineral fertilizers and building materials industries is proceeding along a detailed plan based on the economic rentability of the projects and taking into consideration also the distribution of population according to the national needs of Israel.

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b) The development of the mineral resources contributes directly and enormously to the development and population of the arid zones of the southern part of Israel (the Southern Negev)

The Southern Negev, the area of which is 57% of the area of Israel, has a population of less than 1% of the national population.

This area is the centre of the national natural resources.

The number of workers already employed by the industry and mining in this area is four times higher than the number of those employed by agriculture. According to the realistic plans to populate the Southern Negev 41.4% of the workers will be employed by the industry and mining as compared with 23.2% in Israel as a whole.

Since the Southern Negev as an Arid Zone has very poor chances to develop its agriculture, industry is almost the only branch of direct productive importance when 69% of its employees are already connected with the mineral industry.

Out of IL360,000,000 which will be invested until 1970 in the development of the mineral industry over 85% will be invested in the Southern Negev.

The Port of Eilat, the southern gate of Israel to Africa and Asia, is the key to a major part of the minerals' export and its activities and development depend mostly on the development of the mineral industry. This can be illustrated by the fact that in 1961 66% of the exports through Eilat were Potash and Phosphates.

Places of new settlements in the unpopulated Southern Negev are determined according to the minerals' deposits and processings. The development of the mineral resources are also the main factors in the development of transportation and water and and energy resources.

c) New revolutionary discoveries of minerals cannot be expected in Israel

On the other hand we are still very far from exhausting the existing known reserves and exploiting the whole potential of minerals which can be stripped off and produced economically. There is no doubt that using all existing possibilities may serve as a wide and steady basis for the development of a profitable and wide range of basic chemical and petrochemical industries.

The list of minerals which are already being exploited includes the following:

1) Timna Copper Deposit
2) Oron Phosphate Field
3) Dead Sea Minerals
4) Ceramic and Refractoric Clays
5) Industrial Anhydride Gypsum
6) Glass Sand
7) Basic Raw Materials for the Cement Industry

The list of minerals, the exploitation of which has not yet started because further prospection is still necessary, includes the following:

1) Additional Phosphate Fields (Arad, Ein Yahav, Hor Hahar, Hamaishar)
2) Primary Copper Deposits (Eilat-Timna)
3) Iron Deposit (Hematite)-Paran Mountain
4) Feldspars (Nordmarkite, etc.)
5) Asphalts
6) Radioactive Minerals and Non-Metallic Minerals (such as Plastic Clays, Bentonite, Special Limes for the Rubber and Dyes Industries, etc.)

The Ramim Iron Deposit and the Ein-Bokek Oil Shale Deposit have been studied very thoroughly but the best economic way to exploit them has not yet been summarized.

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d) Profitable and maximal development of the natural resources is subject to permanent research efforts

The hard competition with the products of old-based and developed industries, the technological inventions and changes which shake existing markets and discover

new ones, the fact that most of Israel minerals are relatively poor and the rentability of producing them is sometimes marginal; all these and the vital necessity to exploit the national minerals by the most profitable enrichment and processing obliges a long-range planning connected constantly and organically with wide research and development efforts.

Along these calculated efforts the research laboratories of the Development Companies and especially the laboratories of Israel Mining Industries, test, develop and invent new and better processes, products and techniques. The main idea is to develop new uses and create new markets for Israel's mineral resources and the products therefrom.

The I.M.I. Laboratories have developed a process for the economical manufacture of an organic Bromine derivative T.B.E. (tetrabromethane) at a very low price permitting its large-scale application in the enrichment of minerals, instead of the small-scale use that was possible hitherto. T.B.E. has already been manufactured in semi-commercial quantities in the pilot plant set up by the laboratories and world mining industries have already manifested considerable interest.

Another example is Magnesium, one of the salts found in the Dead Sea. The laboratories are presently developing a new fertilizer, Magnesium Phosphate, a compound not hitherto used for agricultural application. Taking advantage of the close proximity of magnesium salts and phosphate deposits in the Southern Negev, a new method for the production of Magnesium Phosphate has been developed which is expected to have great importance as a new fertilizer.

A new process has also been worked out for the production of Phosphoric Acid via Hydrochloric Acid and the first industrial enterprise to apply this process is a chemical concern in Japan.

These are only a few examples of the vital research and development constant activities of the research laboratories in order to develop new products, processes and techniques in the fields of mining, enrichment and processing of the minerals in Israel. The development of these processes causes also a possible additional foreign exchange income through the sale of technological know how abroad.

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-) <u>The rate and success of developing the mineral industry depends upon preparing trained manpower especially for the development and operation of the mines</u>

Our lack of experience in this young and new branch, the dangerous pass from open-cast mining to underground mining in most of the mines, the necessity to make the work more efficient and reduce the production costs; all these oblige urgent and special activities in all possible fields in order to train hundreds of engineers and technicians and thousands of labourers who will be needed during the coming ten years for the development of the mineral industry in Israel.

The problems we are facing are very serious and delicate specially with regard to underground mining. They are serious and complicated because they present a combination of training, safety, income and family matters. The main and most difficult problem is - to find the best and quickest way to ensure the stability and continuity of the trained

and experienced workers.

The Ministry of Development and the development companies are very aware of the vital problem. Only a constant and coordinated effort between all concerned may solve this problem. Certain fruitful efforts have already been done but there is still a real danger that the trained manpower problem may be the bottleneck of the advancement of the mineral industry in the future.

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f) The profitability of the mineral industry depends on reducing the costs of transportation and material handling in the ports

Since the majority of the tonnage consists of products whose price is very low and the relative volume of their transport is high, the land and naval trasnportation expenses become the main component of the product cost.

This is specially true of the Southern Negev where the relative distances between the mineral deposits and the ports are long, the transportation means are in their very preliminary stage of development and the whole area is relatively far away from the centre of the country. In order to be in a position to compete with international export prices as the only way to ensure and widen our exports (such as Phosphate rock to the Far East) it is necessary to shorten and cheapen the ways of transportation and reduce loading and unloading costs in the ports.

The new road from Sdom to Eilat (Sdom is the centre of Dead Sea Works Limited), continuing the railroad to Oron and Eilat and the building of bulk storing house and loading and unloading facilities in Eilat will increase the profitability of the plants. Another alternative solution to this problem, a technological one, depends upon deepening the production, further processing of the raw minerals and thus raising the price of ton material and reducing tremendously the relatively high transportation costs.

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The experience of Israel with regard to ways and problems related to all prospection, research, planning and implementation activities connected with our mineral resources is very short in time but very fruitful from an economic point of view and very constructive and educating from the point of view of the New States seeking for information, experience and know how in order to develop their own mineral resources.

The experience of Israel in the exploitation of her mineral resources may be divided into three sections:

a) Dead Sea Minerals

The Dead Sea, the saltiest lake in the world, contains 45,000 million tons of salts (NaCl, KCl, $MgBr_2$, $MgCl_2$, etc.) dissolved in 147 km^3 water. From an economic point of view this is in fact an infinite source of vital minerals. The plans for the extraction of the treasures of the Dead Sea on a far greater scale than hitherto are already in a very advanced stage of preparation.

The main development project is the increase of the Potash output from 150,000 tons a year at present to 600,000 tons annually by 1967. This project will necessitate

the addition of more evaporation pans, more transport facilities and the utilization of at least 100 shiploads to carry the Potash to the export markets. It is also planned to produce granulated Potash which will facilitate bulk shipments. In connection with the expansion plans of the Dead Sea Works, the necessary road network is being laid. The new road will shorten the distance from Sdom to Eilat by 60 kms, eliminating twists and turns. The saving in transport will make it possible to save $1 or $2 a ton from the present price of $32 to $33 per ton of Potash.

Ninety-eight percent of the Potash output of the Dead Sea is already being exported to twenty countries including Italy, England, Japan, South Africa, the Philippines, Formosa and Sweden. Already in the financial year 1963-64 it is hoped to attain an export volume of $7 million.

The Bromine plant at Sdom has a capacity of 10,000 tons. It is expected that by 1966 Israel's Bromine will be the cheapest in the world. A plant for the production of organic and inorganic Bromine compounds is being erected. Production will begin at the end of the year. A plant for the manufacture of Table Salt is also being set up with a productive capacity of 2,000 tons a year, all of it destined for export. Other projected plants include 75,000 tons of Magnesium Oxide of very high quality.

The total investments within the next three-four years will run into IL200 million.

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b) Israel's Main Mines

1) Timna Copper Mine

The copper industry is the youngest of our basic industries exploiting the natural resources of the country. The annual production today is 8,000 tons of Cement Copper containing 75% of Metallic Copper - which is still sent abroad for final processing. The proven ore reserves enable and justify the plans to produce 15,000 tons of Metallic Copper per year. The future plans also include the local production of Pure Copper. The underground mine which is being prepared will supply 4,000 tons of ore per day by 400 miners who should be recruited, trained and maintained.

Israel imports today 7,000 tons of Electrolytic Copper and its products, while in the near future Israel will produce and supply its own Copper needs.

2) Oron Phosphate Field

Proven reserves of many millions of tons (P_2O_5 - 22-24%) have been secured while the detailed prospection still goes on. The present production is 250,000 tons of mechanically-beneficiated Phosphate (P_2O_5 - 28.5-29.5%) half of which is exported, 30,000 tons of flotated beneficiated Phosphate (P_2O_5 - 30-31%) and 20,000 tons of Calcined Phosphate (P_2O_5 - 38%) at a semi-industrial plant. The future plans include at its first development stage four additional plants which will employ five hundred workers:

a) 400,000 tons of Calcined Phosphate (P_2O_5 - 38%)
b) 100,000 tons of Triple-Superphosphate P_2O_5 - 48-50%)
c) 40,000 tons of Defluorinated Phosphate
d) 60,000 tons of Soda Ash

The majority of the tonnage of the above-mentioned products will be exported. The new promising Phosphate field at the Arad Area in the Southern Negev (at least 15 million tons of Phosphate rock 28-29% P_2O_5) is now being evaluated from a technological and economic point of view for the best way of immediate exploitation.

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3) Clays and Glass Sand

Supply of raw materials for the ceramic, glass and refractory industries. During 1961-62 34,000 tons of various Clays (including Flint Clay) and 27,000 tons of Glass Sand were mined and processed. An example of the right way of investigating a raw material is the research on the local Flint Clay. This rock, which was found some years ago, was first tested roughly in the field and the laboratory. After concluding that its extraction was economical, the mining company Negev Ceramic Materials Limited performed an exact prospection with the cooperation of the Geological Survey. The chemical analyses were made by the Ceramics Research Association. Simultaneously, the study of seperation of the Iron impurity was made by Israel Mining Industries.

The future plans based on the very high quality of the local Flint Clay (high Alumina content) and its proven reserves of millions of tons include a plant which will mine, beneficiate and calcine 80,000 tons of Flint Clay (mostly exportable to Europe) and additional plants for the production of Cement Alumina and Pure Alumina. All the new plants will employ 400 workers.

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c) Unexploited Minerals

The main unexploited minerals about which we have gathered enough geological, technological and economic data and information without being yet able to start exploiting them because of certain various doubts and problems are the Ramim Iron deposit and the Ein Bokek Oil Shale deposit.

The Iron deposit at Ramim was discovered in 1954. Detailed prospection disclosed that the potential reserves of ore containing 27-28% Iron reaches 40 million tons. The thickness of the ore layer is 2.5 metres. By mechanical beneficiation the ore can be concentrated up to 42%. A detailed development plan has been prepared whereupon an investment of IL6.5 million is needed for the development of the mine and the beneficiation plant processing 1,500 tons of ore per day producing 205,000 tons of concentrate per year occupying 160 workers. It is hoped that a practical and quick way to use this local ore at Steel Town will be found.

The Oil Shale proven reserves at Ein Bokek reaching 100 million tons have been investigated very thoroughly from a technological and economic point of view as a possible raw material for generating power, producing cement, etc. The economically profitable way to exploit this huge and interesting deposit has not yet been summarized.

The development of each mineral generally involves four stages: geological and geophysical prospection, technological research and surveys, economic evaluation and finally the design and erection of exploitation plants. The Geological Survey of Israel plays a very active part in the development of the mineral resources. The functions of this organization include extension of services to operating companies (i.e. in the fields of petroleum, gas, quarries, mining companies, etc.) prospection and exploration on its own behalf and on behalf of clients and research activities.

The prospection methods of the Geological Survey of Israel include the following steps:

a) National Geological Mapping

(The mapping of rocks reveals those which may have an economic application.)

b) Detailed Specific Prospection of Already Discovered Interesting Phenomena.

c) Detailed Surface and Underground Geological Mapping

d) Mineralogical - Petrographical and Chemical Analyses and Tests

The Geological Survey operates in close cooperation and coordination with the Geophysical Institute of Israel. Because of the erratic distribution of commercial mineral deposits below the surface, it has become increasingly important for prospectors the world over and in Israel as well to use geophysical techniques to pinpoint potential accumulations of commercial deposits.

Magnetic iron ore may be discovered, even from a fast travelling airplane, by virtue of its magnetism; radioactive minerals can be found by means of geiger counters; large concentrations of dense minerals such as pyrite deposits could be located by measuring the gravitational attraction at the surface. Members of the Geophysical Institute of Israel performed electrical resistivity and self potential surveys in Wadi Menaiya - today's Timna - long before the establishment of the State of Israel in order to delineate the potentially rich copper zones. Recently, a seismic refraction survey was carried out to determine the extension, depth and dip of bedded copper deposits near Timna.

The Geophysical Institute is currently engaged in perfecting new mineral exploration techniques such as induced polarization, and electro-magnetism which might prove of great benefit in searching for the elusive thinly concentrated copper. Another project which is about to ensue with the participation of the Institute is an aeromagnetic survey of Israel which among other important bits of information might help discover hitherto unknown iron ore deposits.

Following the prospection activities and conclusions the technological research and surveys cover the most vital exploitation problems such as the concentration of the ores, ways of ore dressing, mining methods, further processing of the intermediate products, etc. Very often unique processes, techniques and products are invented and patented as results of a continuous scientific effort to adapt Israel minerals to internationally known processes or to invent new ones and better ones.

As a major result of these research activities Israel is in a position today to offer her knowhow, experience, patents and inventions for the economic exploitation of the mineral resources of the New States, especially in Arica.

The vital economic evaluation takes into basic and brave consideration all economic data (investments, running expenses, marketability, prices, interest, amortization, etc.) in order to supply the potential inventor of the mineral project with all the information leading to the climax of decisions based on the profitability and soundness of the new project. Only when all preliminary geological, technological and economic information and evaluation have been completed justifying the economic exploitation of any new mining project is the road open to the last steps of designing, erecting and operating the new plant.

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The large-scale continued activities carried out in Israel for the location of minerals, the successful development of high-level technological research institutions, the constructive coordinated effort between geologists, engineers and economists towards the best and most economic way to exploit her mineral resources and the planned development of mineral plants by the initiative of the Government may easily serve as an inspiring educating example for less-developed and developing countries.

Since the establishment of the State, in 1948, Israel has been enjoying wide technical assistance for the development of her natural resources. Israel's development projects needed the kind support of highly-developed countries in the fields of knowhow, research, mining and industry connected with her mineral resources and the very vital target of training the vocational manpower. This blessed way of international cooperation in our era is considered most important by us and we believe that even the highly-developed countries may need specialized knowledge and assistence in one branch or the other.

In view of the technological progress achieved in Israel during recent years U.S.A. technical assistance came to an end by mid-1962. Israel is now ripe and willing to contribute her share of technical assistance and respond to the urgent needs of the newly-developing countries.

Although our natural resources are themselves only newly developed, we nevertheless believe that the specific know how and experience we have been gaining in the field of mineral industry development can be shared with other countries facing the same problems. Our experts will now be more than ready to impart their knowledge to the newly-developing countries in Africa and Asia with the same pioneering approach and guiding feeling that international technical assistance is an ideal way towards full international cooperation.

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